Progress Report No. 5
Wetlands Ecology, SR140
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A. Title: ERTS-1 Data User Investigation of Wetlands Ecology, SR140

B. Principal Investigator: Dr. Richard R. Anderson, The American University, UN-006.

C. Problems: Winter data over our southern test site (S.C. - Ga.) were requested for January and February 1973. Unfortunately, cloud cover was a problem and the data were not usable. Substitute data from December 1972 have been ordered retrospectively. At this date we still have not received approval of our Data Analysis Plan submitted December 14, 1972. We are currently proceeding with data analysis even though our plan has not been approved.

D. Accomplishment during February and March include:

1. Development of techniques to utilize the Diazo color subtractive process to produce high contrast color composites of ERTS data. The winter data is quite dense in all bands. This has required experimentation to determine exposure time and color display to best delineate grey levels within the wetlands. Extended exposures (12 - 15 min.) of ERTS positive transparencies to the Diazo film has brought out density differences in wetlands not visible on products as delivered from Goddard.

2. Work has progressed well at both the northern (Chesapeake Bay) and southern (S.C. - Ga.) test sites. The following is a summary of results of the last two months data analysis at each site.

A. Northern test site (Nanticoke River, Maryland - Chesapeake Bay and Assateague Island)

Use of a Bausch and Lomb Transfer Scope in combination with 1:1,000,000 scale ERTS format permits enlargement of the image and construction of maps and overlays to a scale of 1:250,000. ERTS MSS 7 (1079-15140) image of the Chincoteague salt marsh complex has been enlarged to this scale and mapped to show six categories: (1) upland vegetation and beach, (2) water, (3) Spartina alterniflora/Salicornia sp. association, and (4) Spartina patens/Distichlis spicata/ Iva frutescens association, (5) spoil fills, and (6) fresh-water impoundments. The spectral reflectance of the Spartina alterniflora/Salicornia sp. association is generally low, in part because of the wet mud or peat background below the vertically oriented vegetated layer which averages 7 to 14 inches in height. The reflectance of the

mudflats and water in this band is still less. The relatively high reflectance of Spartina patens permits sufficiently large areas of the Spartina patens/Distichlis spicata/Iva frutescens association to be delineated. The upper wetland boundary is generally sharp except where broad transition zones exist. The marsh-water interface is sometimes difficult to determine in areas interlaced with numerous small tributaries or sparse patches of vegetation. Sand and marsh at the mouth of Chincoteague Bay are not shown on the USGS 1:250,000 map published in 1966. Spoil areas may be easily separated from reflective vegetation by referring to bands 4 and 5 or by using a color composite since they are highly reflective in all four bands.

The Nanticoke River marsh area (MSS band 7, ERTS image 1079-15133) has been enlarged to 1:250,000. Species composition in this marsh is typical of a near-saline environment. A map of the area was made by overlaying the 1:1,000,000 scale image enlarged with an overhead projector. A number of tree islands dot the marsh, the largest of which contains the small community of Elliots' Island. The marsh vegetation includes a Juncus roemarianus/Scirpus sp./Spartina alterniflora association in the lower marsh areas and a high marsh community, Spartina patens/Distichlis spicata/Iva frutescens/Baccharis halimifolia, primarily located along the edges and near the single road. Toward the northern end of the marsh, the water becomes more brackish and less saline. Stands of Spartina cynosuroides occupy the stream margins within this portion of the marsh. Isolated stands of Phragmites communis occur, but they are generally too small to be detected on the ERTS imagery. Because the signature of the dominant low marsh species Juncus roemarianus is close to that of water, it is difficult to delineate the marsh-water interface within the marsh itself.

Mapping at a scale of 1:250,000 is adequate for the general delineation of large marshes and for rather gross plant species associations. Enlargement of the imagery to a scale of 1:125,000 provides additional information when processing is done to enhance the contrast in the denser part of the image. Overlays can be made directly from the prints which show the marsh-water interface and upper wetland boundary clearly. Where broad successional zones exist, these can also be mapped. Smaller plant communities, occasionally less than 25 meters in diameter, can be identified. In addition, open and vegetated ditches dug for drainage or agriculture can be recognized and indicated on the map.

The Nanticoke marsh was experimentally enlarged from the 1:1,000,000 scale to approximately 1:24,000. All the boundaries seen in the other scales became blurred. It appears that unless the optics of the enlarging system are exceptionally good, this scale would only be useful for theme extractions such as upland, dry marsh, wet marsh and open water where placing of boundaries is not critical.

B. Southern test site (South Carolina - Georgia)

Reprocessed 1:250,000 scale enlargements of MSS band 7 (No. 1046-15324, Sept. 6, 1972) have been used for interpretation of this test area. Good tonal differentiation is present in the coastal marshland but loss of detail in the upland occurs. The upper wetland boundary is clearly seen in most of the image although patchy clouds may be mistaken for upland or tree islands in the marsh. Lagooning for water-side home development is visible near Burnside, Georgia, on the Vernon River. Of possible greater significance is the marshland ditching visible in the Fort McAllister area of the Ogeechee River. Ditching causes drying out and accelerates vegetational succession to dryland species and is therefore undesirable as currently practiced for mosquito control and agriculture in many areas. It has been assumed that the resolutional limitation of ERTS imagery would not allow definition of ditching practices. At least in this area that assumption was incorrect.

Various vegetational features are also clearly shown. Tonal characteristics of marshland vegetation in Ogeechee River are considerably different from the nearby Medway River. The ground investigations have shown that Juncus roemerianus is the dominant vegetation in the Red Bird Creek area. The lighter tones of this species contrast nicely with the darker tones of Spartina alterniflora which makes up the bulk of the vegetation in Medway River.

Tonal structure in the Bear River marshes indicate that separation of at least two growth forms of S. alterniflora will be possible. The tall form along the creeks images lighter than the shorter forms. It appears that gross productivity estimates may be made from the imagery. The lightest tones in these marshes are at the "loop" in the Ogeechee River (Spartina cynosuroides) and off Kilkenny Creek near Belle Island (mixed populations of Borrichia frutescens and Spartina alterniflora on slightly elevated ground).

3. Field trip to Georgia to evaluate summer and winter ERTS images.

4. Meeting at Johnson Space Center, Houston, on handling and interpretation of Bendix 24 channel multispectral scanner data. Tentative arrangements have been made with Ruth Whitman at NASA/Langley to utilize the LARSYS at GSFC for analysis of the scanner data.

5. Initiation of trial mapping of wetlands from a saline coastal marsh, inland to head of tidal influence, to determine constraints and procedures.

E. Significant Results:

ERTS-1 imagery (enlarged to 1:250,000) is an excellent tool by which large area coastal marshland mapping may be undertaken. If states can sacrifice some accuracy (amount unknown at this time) in placing of boundary lines, the technique may be used to do the following:

1. Estimate extent of man's impact on marshes by ditching and lagooning and accelerated successional trends.

2. Place boundaries between wetland and upland and hence estimate amount of coastal marshland remaining in the state.

3. Distinguish among relatively large zones of various plant species including high and low growth S. alterniflora, J. roemerianus, and S. cynosuroides.

4. Estimate marsh plant species productivity when ground based information is available.

F. Papers presented at following:

1. ERTS-1 Symposium, March 6, 1973.

2. University of Tennessee, Space Institute, March 28, 1973.

3. University of Connecticut Water Resources Institute, January 30, 1973.

G. None.

H. None.

I. None.

J. April 5, 1973. Requested following data retrospectively over southern test area due to cloud cover during the January - February time period when we were scheduled to receive data.

1. December 4, 1972. Orbit 1867. Frames 1134-15213 (4, 5, 6, 7).

2. December 5, 1972. Orbit 1881. Frames 1135-15272 (4, 5, 6, 7).

3. December 24, 1972. Orbit 2146. Frames 1154-15332 (4, 5, 6, 7).